PFAS Study

St. Croix County - 2024

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St. Croix County Wisconsin
Innovation Through Cooperation

Community Development

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Executive Summary:

Groundwater is the primary water source for St. Croix County, serving municipalities, industries, and approximately 45,000 rural residents through an estimated 17,000 private domestic wells. While municipal water undergoes regular monitoring, private well owners are responsible for managing their own wells, including deciding when and what to test for and how to address any issues. In response to growing concerns about per- and polyfluoroalkyl substances (PFAS), the St. Croix County Land and Water Conservation (LWCD) conducted a PFAS study in 2024.

In a prior study conducted in 2023, the Wisconsin Department of Natural Resources (DNR) collected 54 samples from public water systems, including 27 from municipal community wells, 19 from non-transient non-community wells, and 8 from other-than-municipal community wells. Out of these 54 wells, 17 had PFAS detections.

In the spring of 2024, LWCD staff collected eight PFAS samples from private wells. The study aimed to determine if PFAS concentrations in private wells were higher compared to those in public water systems, since private wells are typically shallower than public wells.

During the designated sampling week, County LWCD staff traveled to each participant household. Staff then followed the sampling protocols provided by the Wisconsin State Laboratory of Hygiene. Once all the samples were collected they were shipped to the Wisconsin Laboratory of Hygiene for comprehensive analysis.

Well Selection:

The purpose of this study was to gain insights into PFAS concentrations across the County. Due to the high cost of PFAS sampling, the LWCD staff focused on specific private wells near public wells known to have PFAS contamination.

In early January 2024, letters were mailed to recruit private well owners for participation in the study. After multiple attempts, staff successfully enlisted eight willing participants. These participants were in the Towns of Hudson, Star Prairie, and Hammond.

Water Chemistry Results:

The analysis of PFAS compounds found in the eight private wells is summarized in (Figure 1). The box plot reveals that a total of seven chemical compounds were detected. The most frequently detected compound was Perfluorobutane sulfonate (PFBS), which was found in seven out of the eight private wells. According to the Minnesota Department of Health, PFBS is commonly used in non-stick and stain-resistant consumer products, food packaging, fire-fighting foam, and various industrial processes.

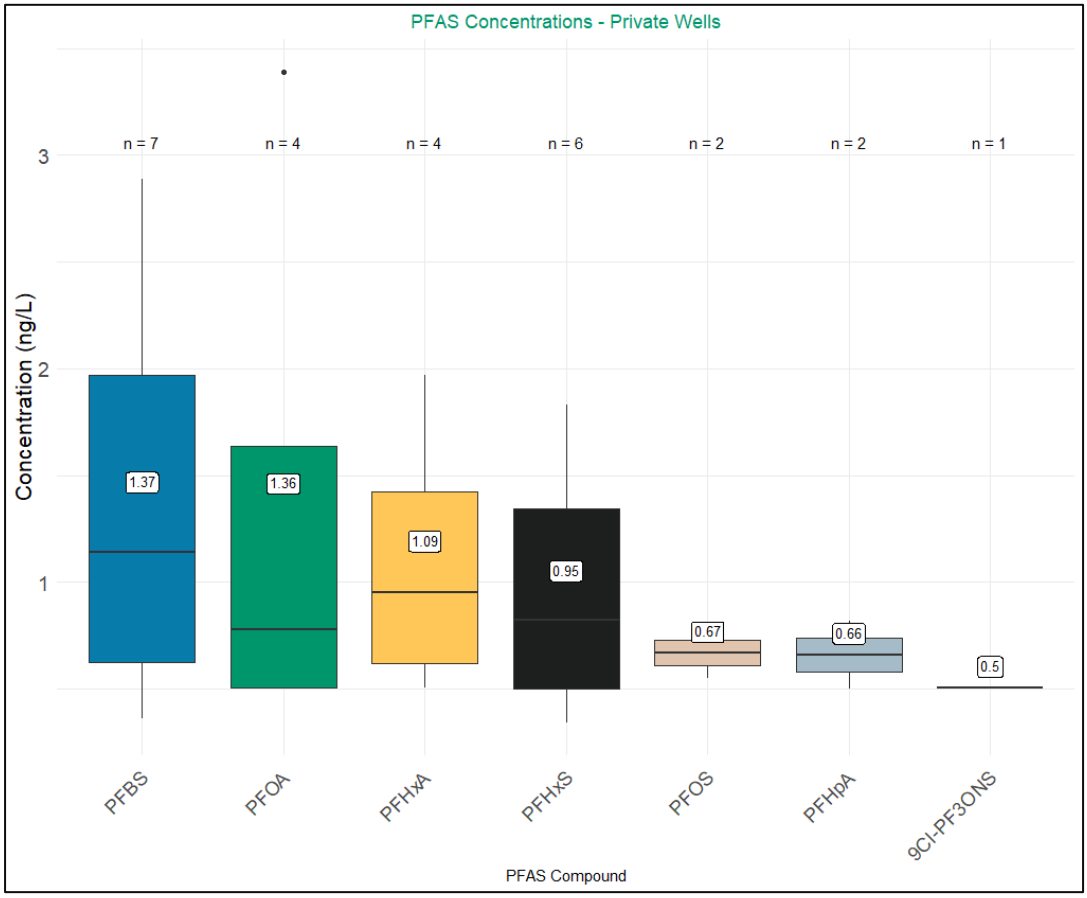

Figure 1: This box plot graph displays PFAS chemicals found in all 8 private wells.

The water quality standard for PFBS in drinking water is set at 70 ng/L (parts per trillion). The analysis results indicate that the mean concentration of PFBS in the eight private wells was 1.37 ng/L, with the maximum concentration recorded at 2.89 ng/L.

The second most frequently detected chemical was Perfluorohexanesulfonate (PFHxS), with six out of eight private wells testing positive for this contaminant. According to the Minnesota Department of Health, PFHxS is used as a surfactant in various industrial and commercial products, including food packaging, stain and water-resistant materials, fire-fighting foams, and paint additives. It is typically detected near production or usage sites.

The EPA water quality standard for PFHxS is set at 10 ng/L (parts per trillion). The analysis results indicate that the mean concentration of PFHxS in the eight private wells was 0.95 ng/L, with the maximum concentration recorded at 1.83 ng/L.

Additionally, the third most found chemicals were Perfluorooctanoic acid (PFOA) and Perfluorohexanoic acid (PFHxA). According to the Minnesota Department of Health, PFOA is used in non-stick and stain-resistant consumer products, food packaging, fire-fighting foam,

and industrial processes. PFHxA is commonly used in stain-resistant fabrics, paper food packaging, and carpets.

The EPA water quality standard for PFOA is set at 4.0 ng/L (parts per trillion), and for PFHxA, it is set at 560,000 ng/L (parts per trillion).

The analysis results indicate that the mean concentration of PFOA in the eight private wells was 1.36 ng/L, with the maximum concentration found at 3.39 ng/L. For PFHxA, the mean concentration found was 1.09 ng/L, with the maximum concentration recorded at 1.97 ng/L.

Additionally, the following chemicals were found in the private wells:

- **PFOS (Perfluorooctane Sulfonic Acid)**: This chemical is used in non-stick cookware, firefighting foams, protective coatings, and waterproof clothing. It was detected in two wells.
- **PFHpA (Perfluoroheptanoic Acid)**: Used in consumer products for water or stain protection and as a surface coating. It was detected in two wells.
- **9Cl-PF3ONS (9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate)**: Used in various industrial applications. It was detected in one well.

For a complete list of the EPA's drinking water standards for each compound, please refer to (Table 1). It is important to note that no wells in this study have tested over the drinking water standard for any PFAS chemical.

Chemical	MCL
PFBS	70 ng/L
PFHxA	560,000 ng/L
PFHpA	*
PFHxS	10 ng/L
PFOS	4.0 ng/L
9Cl-PF3ONS (ng/L)	*
PFOA (ng/L)	4.0 ng/L
Hazard Index	1 (Unit Less)

Table 1: This table represents all the PFAS chemicals found in the 8 private wells along with the EPA's Maximum Contaminate Level (MCL) associated with each chemical. Lastly, the asterisk symbol in the table means there is no established EPA water quality standard for this chemical.

PFAS Spatial Distribution:

The spatial distribution of PFAS chemicals is beginning to come to light in St. Croix County. In the past, funding has not been available to test for PFAS contamination in St. Croix County.

In 2023, the Wisconsin DNR used ARPA funds to conduct a statewide analysis of PFAS which included 27 municipal wells, 19 non-transient non-community wells, and 8 other-than-municipal community wells in St. Croix County. In 2024, LWCD staff collected water samples from 8 private wells to add to this database. In total, 62 wells have now been tested across St. Croix County.

The data collected thus far indicates that no well exceeded the maximum contaminant level (MCL) for PFAS chemicals. Overall, 24 out of the 62 wells have been found to contain PFAS chemicals which equates to (39%). The breakdown of the 24 wells can be found below (Figure 2):

- **Public Municipal Community Wells**: Four wells were found to have PFAS chemicals including Hudson Waterworks, Baldwin Waterworks, and Somerset Waterworks.
- **Non-Transient, Non-Community Wells**: Eleven wells were found to have PFAS chemicals in the Towns of Hudson, Baldwin, and Warren.
- **Other Than Municipal, Community Wells**: Two wells were found to have PFAS chemicals in the Towns of Star Prairie and Hudson.
- **Private Wells**: Seven private wells tested by the County LCD were found to have PFAS chemicals. These wells are in Hudson, Hammond, Stanton, and Star Prairie

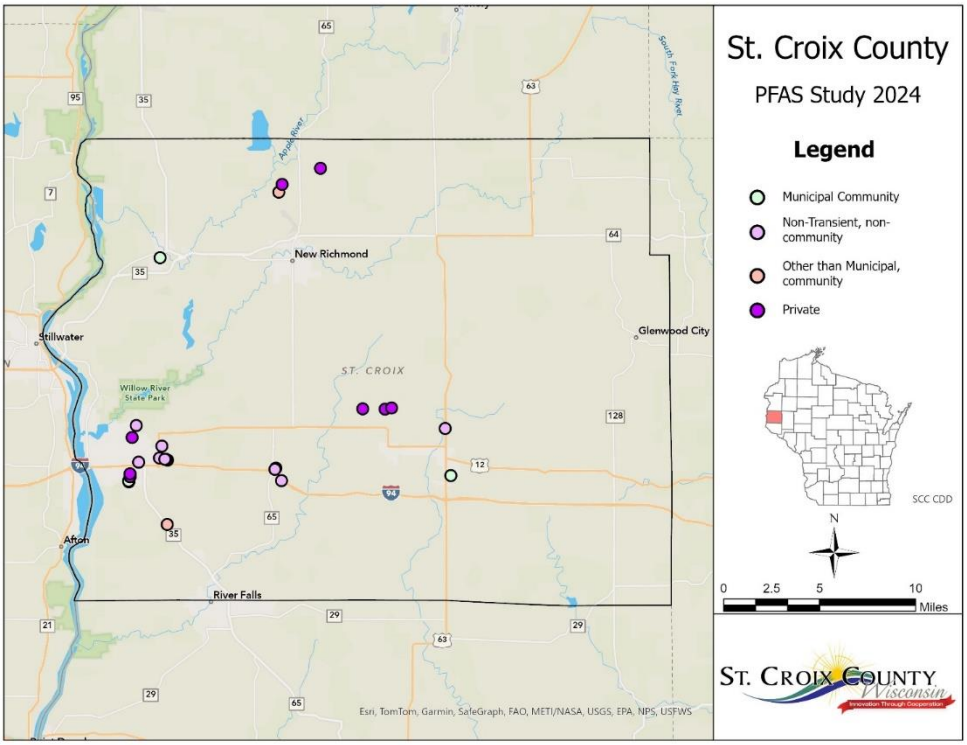

Figure 2: This map displays all known wells in St. Croix County that contain PFAS chemicals. This data was collected by Wisconsin DNR and County LWCD staff.

PFAS Study Areas:

The four major sources of PFAS are fire training/fire response sites, industrial sites, landfills, and wastewater treatment plants/biosolids. Since PFAS contamination is site-specific, it is crucial to categorize the 24 wells found to have forever chemicals based on their proximity to each other for further analysis.

To facilitate this, three groups were developed, comprising a total of 17 wells:

- **Group One (Hudson Study Area):** This group includes private, municipal, and non-transient non-community wells.
- **Group Two (Hammond/Baldwin Study Area):** This group includes private and non-transient non-community wells.
- **Group Three (Star Prairie / Stanton Study Area):** This group includes private and non-transient non community wells.

PFAS – Hudson Study Area – Overview.

In the Hudson study area, a total of eleven wells were found to have PFAS chemicals. These eleven wells include two municipal wells, three private wells, and six non-transient non-community wells (Figure 3).

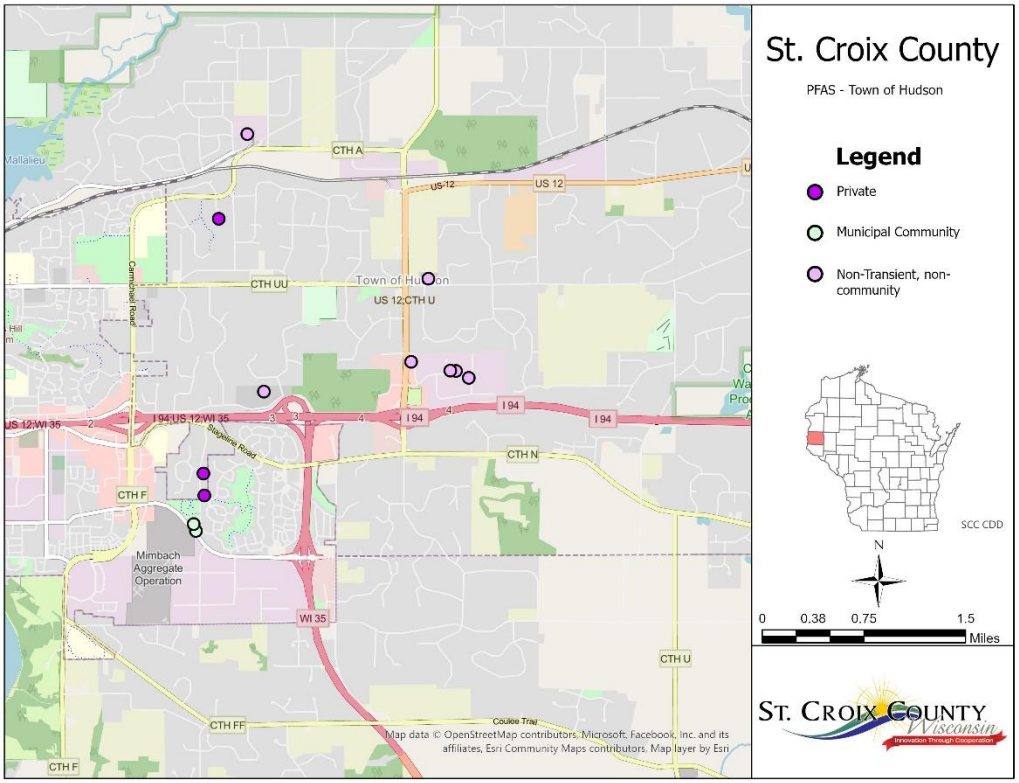

Figure 3: Location map of PFAS samples in the Town of Hudson located in St. Croix County Wisconsin.

Through analysis, it was found that the majority of the wells contained the following PFAS chemicals: PFBS, PFHxA, PFOS, and PFOA. Additionally, only two wells were found to have PFHpA (Figure 4).

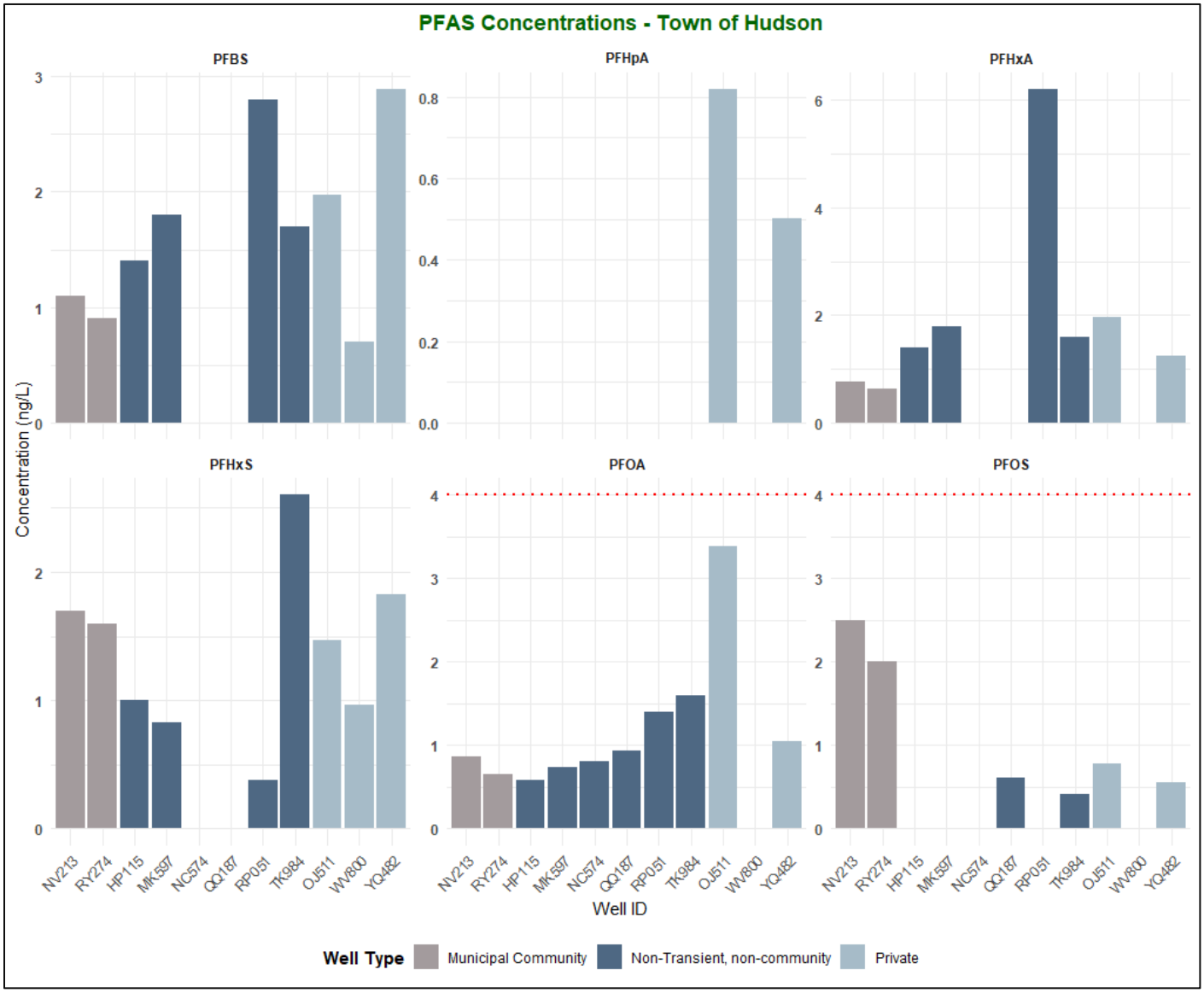

Figure 4: This graph displays the PFAS chemicals found in each well in the Town of Hudson. Note the red horizontal line represents the MCL for that PFAS chemical.

Hudson Study Area – Analysis:

In addition, it was observed that the concentrations of PFBs, PFHxA, and PFOA show a decrease in concentration with increasing casing depth. This trend suggests that these contaminates maybe more prevalent in shallower groundwater, potentially due to more recent or surface-level contamination sources.

As for PFOS and PFHxS these chemicals exhibit an increase in concentration with increasing casing depth. This could imply that these contaminates have percolated deeper into the aquifer over time.

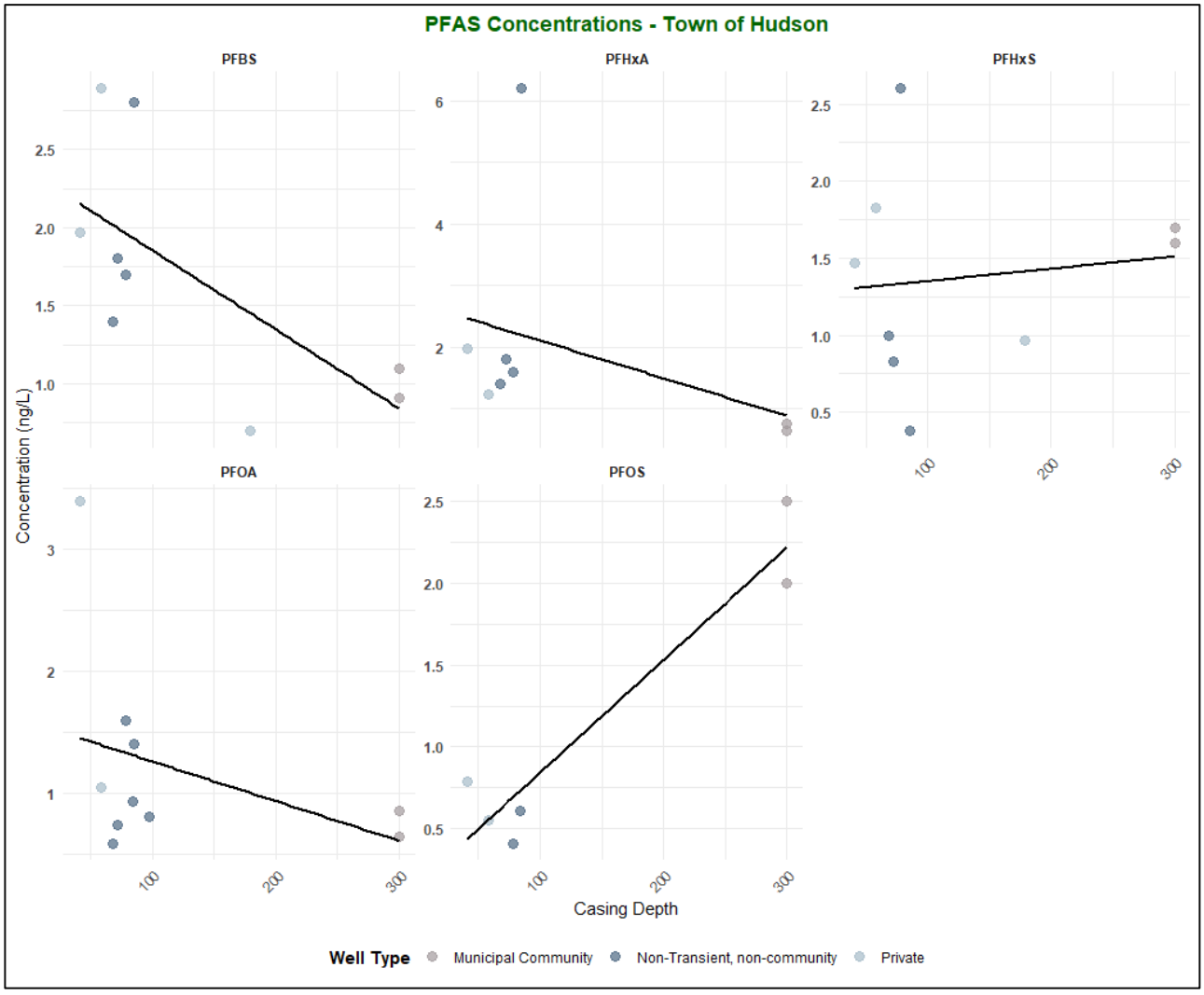

Figure 5: This graph scatter plot illustrates the relationship between casing depth and the concentrations of various PFAS chemicals found the Town of Hudson.

PFAS – Hammond/Baldwin:

The Hammond/Baldwin study area included a total of five wells. Two of the wells were sampled by the DNR in 2023: Baldwin's municipal community well and a non-transient, non-community well for the Christian school located north of Baldwin. The other three wells are private wells sampled by LWCD staff, located in the Town of Hammond (Figure 6).

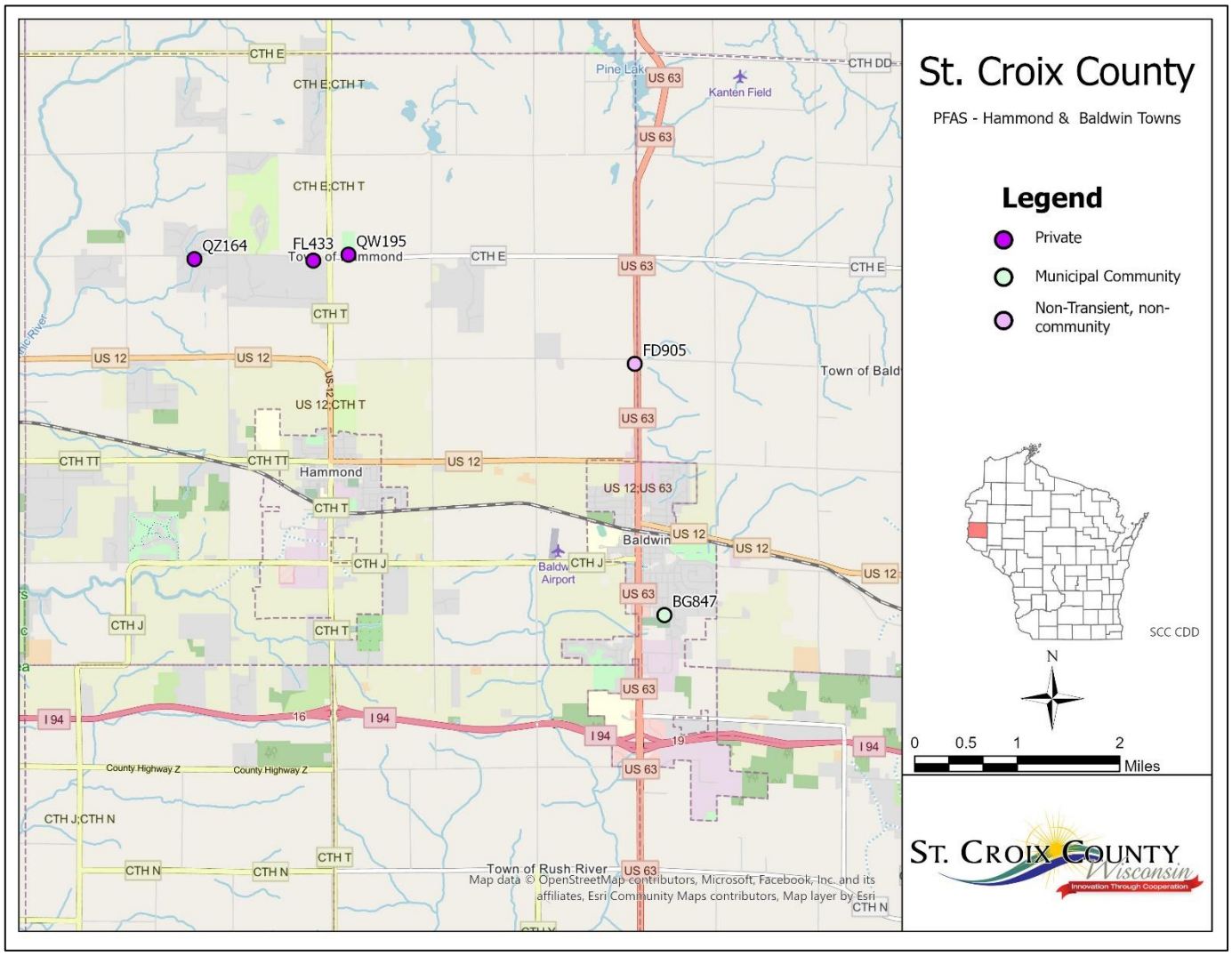

Figure 6: This map displays the wells sampled for PFAS in the Hammond and Baldwin study area.

Through analysis of the five wells in this study area. It was found that four out of the five wells contained PFAS chemicals (Figure 7). These chemicals included the following: PFBS, PFHxA, PFHxS, and PFOA.

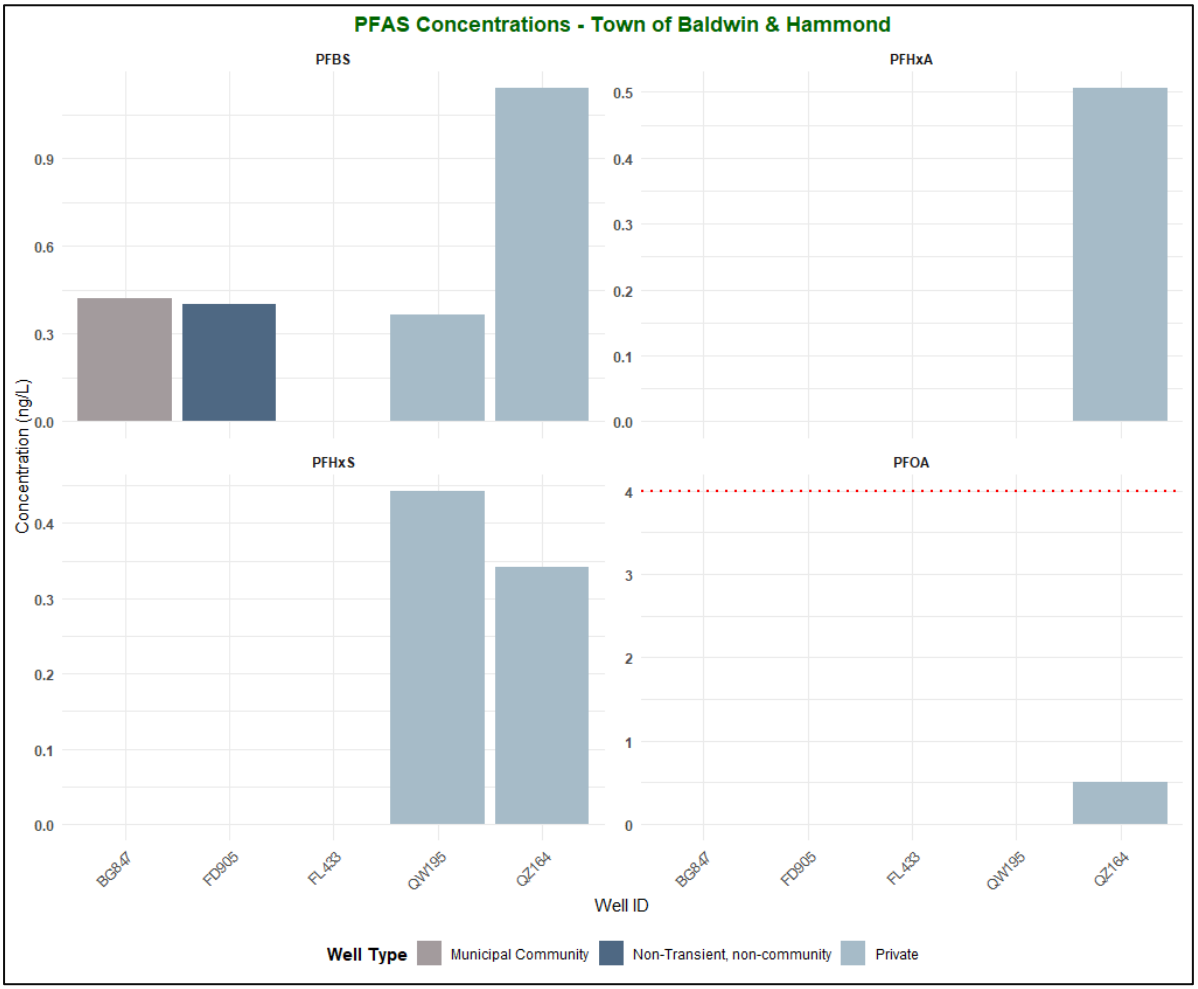

Figure 7: This graph displays the PFAS chemicals found in each well in the Town of Hammond and Baldwin.

The most prevalent chemical found in the Hammond/Baldwin sample group was PFBS, detected in four out of the five wells. Similar to the findings in the Hudson study area, there is a relationship between casing depth and PFBS concentration. As casing depth increases, PFBS concentrations decrease (Figure 8).

Additionally, the other chemicals found were PFHxA, PFHxS, and PFOA. These chemicals were detected only in two private wells (Well ID: QZ164 & QW195).

One possible reason for the presence of these chemicals could be related to their casing depths. The three private wells sampled by LCD staff were near one another (Figure 9). The casing depth for well QZ164 is 41 ft, and the casing depth for well QW195 is 60 ft. As for well FL433, the casing depth was 210 ft.

Through analysis, it was found that well QZ164, which has the shallowest casing depth, had four PFAS chemical detections, including PFBS, PFHxA, PFHxS, and PFOA. Well, QW195, which has the second shallowest casing depth, had two PFAS chemical detections: PFBS and PFHxS. Lastly, well FL433, with the deepest casing depth at 210 ft, was found to have no PFAS chemicals.

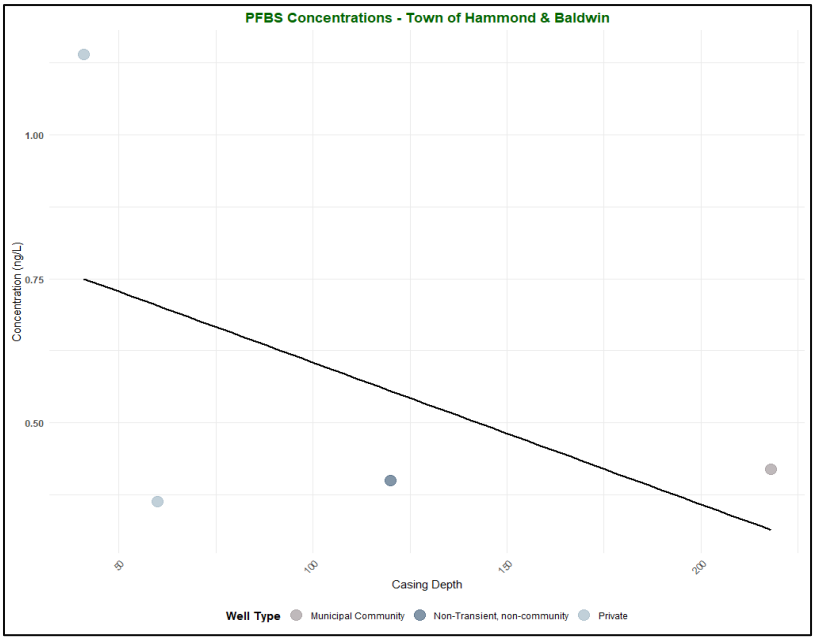

Figure 8: This scatter plot illustrates the relationship between casing depth and PFBS concentrations in the Hammond/Baldwin study area.

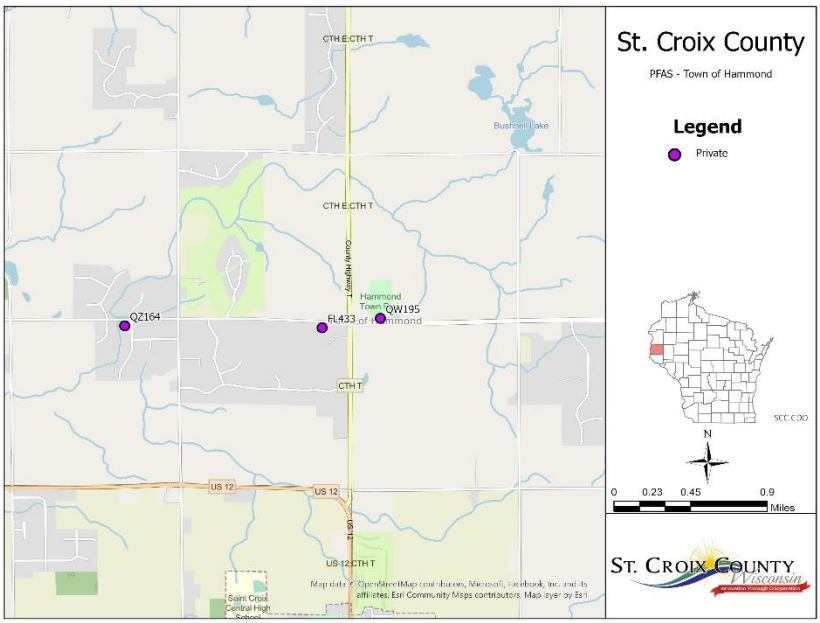

Figure 9: This map displays the private wells sampled by LCD staff in the Town of Hammond.

PFAS Star Prairie/Stanton:

The Star Prairie and Stanton study area included a total of three wells. One well belongs to the Wall Street Village mobile home park and is classified by the DNR as an "other than municipal, community" well.

This well was sampled by DNR staff in 2023 for PFAS chemicals. Additionally, the other two wells are private wells and were sampled by LCD staff in 2024 (Figure 10).

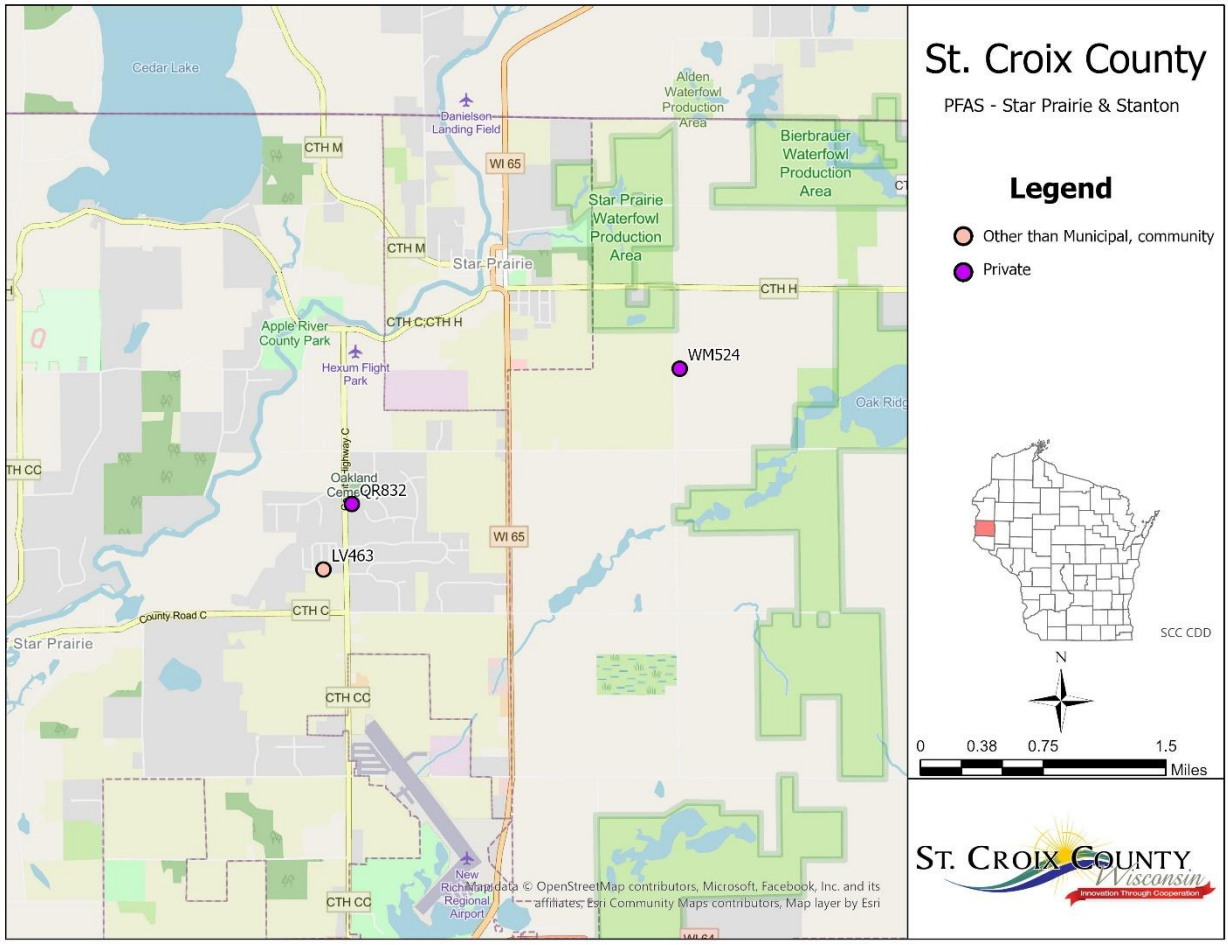

Figure 10: This map displays the PFAS sample locations for the Stanton and Star Prairie study areas.

Through analysis, it was found that all three wells contained PFBS. Well LV463, which is the Wall Street Village mobile home park well, had the lowest PFBS concentration at 0.43 ng/L. The highest PFBS concentration observed was in a private well QR832, at 1.97 ng/L (Figure 11).

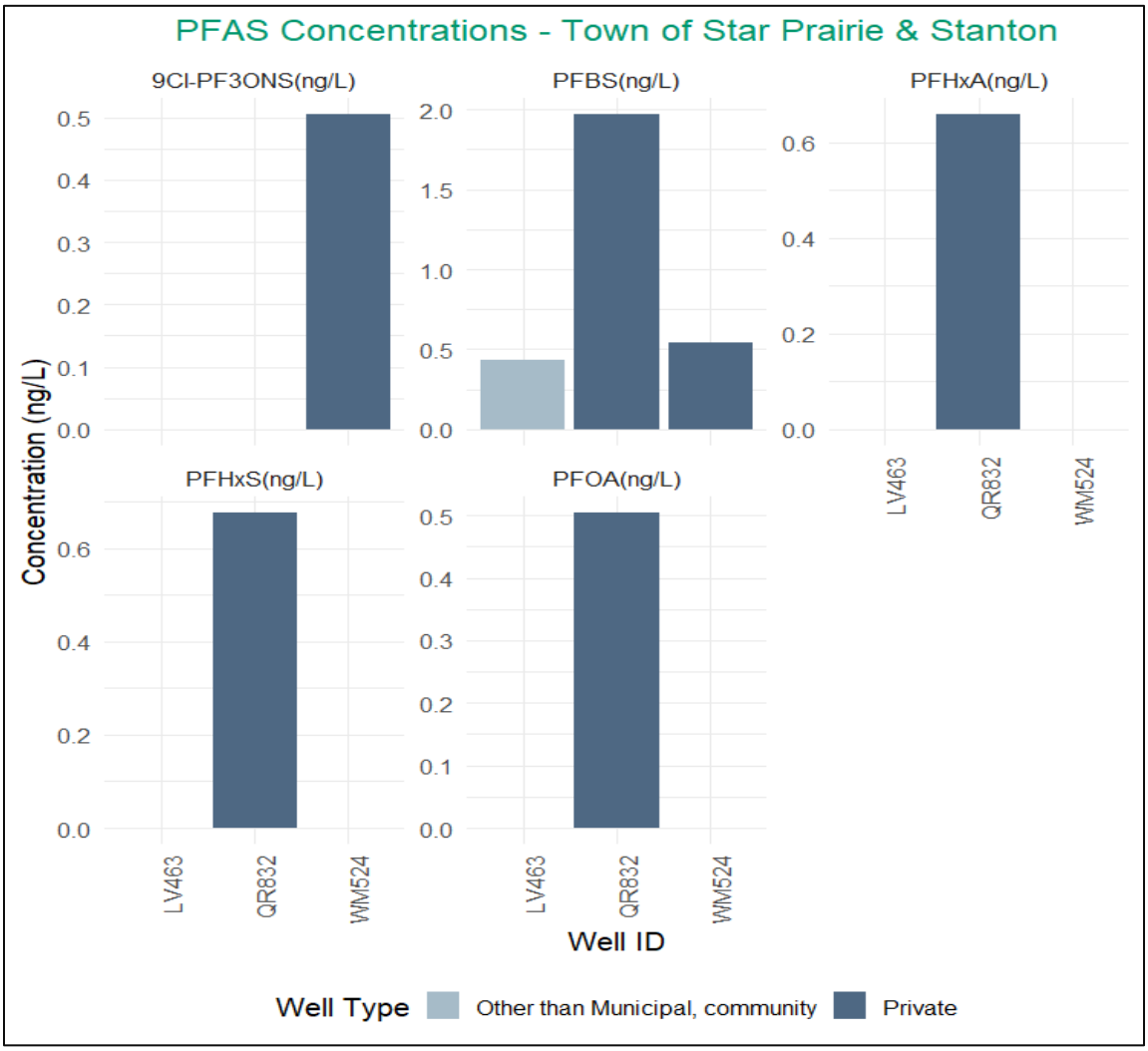

Figure 11: This graph displays the PFAS chemicals found within the Stanton and Star Prairie study area.

The QR832 and LV463 wells are roughly 0.45 miles apart from each other. However, one possible explanation for the variation in PFBS concentrations between the wells could be due to casing depth. Analysis of the well logs revealed that well LV463 has a casing depth of 192 ft, while the casing depth for QR832 is 66 ft. This suggests that PFBS might be more prevalent in shallower aquifers.

Closing Statement:

By conducting this PFAS study, County staff have been able to gather key information regarding forever chemicals our water supply in St. Croix County. Utilizing publicly accessible data from the DNR and combining it with the eight private well water samples obtained by LWCD staff, County staff have begun to understand which areas of the County are impacted by PFAS chemicals.

Through the data gathered thus far, it has been found that no well exceeds the drinking water standard for any of the PFAS chemicals. Additionally, it has been observed that PFBS is the most commonly found PFAS chemical in St. Croix County's aquifer. This chemical has been detected in all well types ranging in depths from 108 ft to 410 ft.

Although no wells were found to be over the drinking water standard for PFAS chemicals, additional data collection is still recommended. In total, 63 PFAS samples have been collected in St. Croix County. However, with approximately 17,000 wells in the County, less than 1% of the wells have been tested for forever chemicals.

By collecting additional PFAS samples, County staff will be able to conduct further analysis to determine if there are specific areas of concern in St. Croix County. At this time, with the limited number of samples, this cannot be determined. However, the data collected thus far has provided key insights into PFAS chemicals in the County's aquifer. Private domestic wells located near deep municipal wells that had PFAS detections did not have PFAS over the MCL drinking water limits. There was concern that shallower wells in vulnerable areas might exceed the MCL.

Lastly, it is important to recognize the eight private well owners who participated in this study. Without their participation, LWCD staff would not have been able to collect key information regarding PFAS chemicals in the County's aquifers.